

(c) Acoustic data must be adjusted to the reference conditions specified in this appendix using the methods described in appendix A of this part. Adjustments for speed and thrust must be made as described in section A36.9 of this part.

(d) If the airplane's weight during the test is different from the weight at which noise certification is requested, the required EPNL adjustment may not exceed 2 EPNdB for each takeoff and 1 EPNdB for each approach. Data approved by the FAA must be used to determine the variation of EPNL with weight for both takeoff and approach test conditions. The necessary EPNL adjustment for variations in approach flight path from the reference flight path must not exceed 2 EPNdB.

(e) For approach, a steady glide path angle of $3^{\circ} \pm 0.5^{\circ}$ is acceptable.

(f) If equivalent test procedures different from the reference procedures are used, the test procedures and all methods for adjusting the results to the reference procedures must be approved by the FAA. The adjustments may not exceed 16 EPNdB on takeoff and 8 EPNdB on approach. If the adjustment is more than 8 EPNdB on takeoff, or more than 4 EPNdB on approach, the resulting numbers must be more than 2 EPNdB below the limit noise levels specified in section B36.5.

(g) During takeoff, lateral, and approach tests, the airplane variation in instantaneous indicated airspeed must be maintained within $\pm 3\%$ of the average airspeed between the 10 dB-down points. This airspeed is determined by the pilot's airspeed indicator. However, if the instantaneous indicated airspeed exceeds ± 3 kt (± 5.5 km/h) of the average airspeed over the 10 dB-down points, and is determined by the FAA representative on the flight deck to be due to atmospheric turbulence, then the flight so affected must be rejected for noise certification purposes.

NOTE: Guidance material on the use of equivalent procedures is provided in the current advisory circular for this part.

[Amdt. 36-54, 67 FR 45235, July 8, 2002; Amdt. 36-24, 67 FR 63196, Oct. 10, 2002; 68 FR 1512, Jan. 10, 2003; Amdt. 36-26, 70 FR 38749, July 5, 2005]

APPENDIXES C-E TO PART 36 [RESERVED]

APPENDIX F TO PART 36—FLYOVER NOISE REQUIREMENTS FOR PROPELLER-DRIVEN SMALL AIRPLANE AND PROPELLER-DRIVEN, COMMUTER CATEGORY AIRPLANE CERTIFICATION TESTS PRIOR TO DECEMBER 22, 1988

PART A—GENERAL

Sec.
F36.1 *Scope.*

PART B—NOISE MEASUREMENT

- F36.101 *General test conditions.*
- F36.103 *Acoustical measurement system.*
- F36.105 *Sensing, recording, and reproducing equipment.*
- F36.107 *Noise measurement procedures.*
- F36.109 *Data recording, reporting, and approval.*
- F36.111 *Flight procedures.*

PART C—DATA CORRECTION

- F36.201 *Correction of data.*
- F36.203 *Validity of results.*

PART D—NOISE LIMITS

- F36.301 *Aircraft noise limits.*

PART A—GENERAL

Section F36.1 Scope. This appendix prescribes noise level limits and procedures for measuring and correcting noise data for the propeller driven small airplanes specified in §§36.1 and 36.501(b).

PART B—NOISE MEASUREMENT

Sec. F36.101 General test conditions.

(a) The test area must be relatively flat terrain having no excessive sound absorption characteristics such as those caused by thick, matted, or tall grass, by shrubs, or by wooded areas. No obstructions which significantly influence the sound field from the airplane may exist within a conical space above the measurement position, the cone being defined by an axis normal to the ground and by a half-angle 75 degrees from this axis.

(b) The tests must be carried out under the following conditions:

- (1) There may be no precipitation.
- (2) Relative humidity may not be higher than 90 percent or lower than 30 percent.
- (3) Ambient temperature may not be above 86 degrees F. or below 41 degrees F. at 33' above ground. If the measurement site is within 1 n.m. of an airport thermometer the airport reported temperature may be used.
- (4) Reported wind may not be above 10 knots at 33' above ground. If wind velocities of more than 4 knots are reported, the flight direction must be aligned to within ± 15 degrees of wind direction and flights with tail wind and head wind must be made in equal numbers. If the measurement site is within 1 n.m. of an airport anemometer, the airport reported wind may be used.

(5) There may be no temperature inversion or anomalous wind conditions that would significantly alter the noise level of the airplane when the noise is recorded at the required measuring point.

(6) The flight test procedures, measuring equipment, and noise measurement procedures must be approved by the FAA.

(7) Sound pressure level data for noise evaluation purposes must be obtained with

acoustical equipment that complies with section F36.103 of this appendix.

Sec. F36.103 Acoustical measurement system. The acoustical measurement system must consist of approved equipment equivalent to the following:

(a) A microphone system with frequency response compatible with measurement and analysis system accuracy as prescribed in section F36.105 of this appendix.

(b) Tripods or similar microphone mountings that minimize interference with the sound being measured.

(c) Recording and reproducing equipment characteristics, frequency response, and dynamic range compatible with the response and accuracy requirements of section F36.105 of this appendix.

(d) Acoustic calibrators using sine wave or broadband noise of known sound pressure level. If broadband noise is used, the signal must be described in terms of its average and maximum root-mean-square (rms) value for nonoverload signal level.

Sec. F36.105 Sensing, recording, and reproducing equipment.

(a) The noise produced by the airplane must be recorded. A magnetic tape recorder is acceptable.

(b) The characteristics of the system must comply with the recommendations in International Electrotechnical Commission (IEC) Publication No. 179, entitled "Precision Sound Level Meters" as incorporated by reference in Part 36 under §36.6 of this part.

(c) The response of the complete system to a sensibly plane progressive sinusoidal wave of constant amplitude must lie within the tolerance limits specified in IEC Publication No. 179, dated 1973, over the frequency range 45 to 11,200 Hz.

(d) If limitations of the dynamic range of the equipment make it necessary, high frequency pre-emphasis must be added to the recording channel with the converse de-emphasis on playback. The pre-emphasis must be applied such that the instantaneous recorded sound pressure level of the noise signal between 800 and 11,200 Hz does not vary more than 20 dB between the maximum and minimum one-third octave bands.

(e) If requested by the Administrator, the recorded noise signal must be read through an "A" filter with dynamic characteristics designated "slow," as defined in IEC Publication No. 179, dated 1973. The output signal from the filter must be fed to a rectifying circuit with square law rectification, integrated with time constants for charge and discharge of about 1 second or 800 milliseconds.

(f) The equipment must be acoustically calibrated using facilities for acoustic freefield calibration and if analysis of the tape recording is requested by the Adminis-

trator, the analysis equipment shall be electronically calibrated by a method approved by the FAA.

(g) A windscreen must be employed with microphone during all measurements of aircraft noise when the wind speed is in excess of 6 knots.

Sec. F36.107 Noise measurement procedures.

(a) The microphones must be oriented in a known direction so that the maximum sound received arrives as nearly as possible in the direction for which the microphones are calibrated. The microphone sensing elements must be approximately 4' above ground.

(b) Immediately prior to and after each test; a recorded acoustic calibration of the system must be made in the field with an acoustic calibrator for the two purposes of checking system sensitivity and providing an acoustic reference level for the analysis of the sound level data.

(c) The ambient noise, including both acoustical background and electrical noise of the measurement systems, must be recorded and determined in the test area with the system gain set at levels that will be used for aircraft noise measurements. If aircraft sound pressure levels do not exceed the background sound pressure levels by at least 10 dB(A), approved corrections for the contribution of background sound pressure level to the observed sound pressure level must be applied.

Sec. F36.109 Data recording, reporting, and approval.

(a) Data representing physical measurements or corrections to measured data must be recorded in permanent form and appended to the record except that corrections to measurements for normal equipment response deviations need not be reported. All other corrections must be approved. Estimates must be made of the individual errors inherent in each of the operations employed in obtaining the final data.

(b) Measured and corrected sound pressure levels obtained with equipment conforming to the specifications described in section F36.105 of this appendix must be reported.

(c) The type of equipment used for measurement and analysis of all acoustic, airplane performance, and meteorological data must be reported.

(d) The following atmospheric data, measured immediately before, after, or during each test at the observation points prescribed in section F36.101 of this appendix must be reported:

- (1) Air temperature and relative humidity.
- (2) Maximum, minimum, and average wind velocities.

(e) Comments on local topography, ground cover, and events that might interfere with sound recordings must be reported.

(f) The following airplane information must be reported:

(1) Type, model and serial numbers (if any) of airplanes, engines, and propellers.

(2) Any modifications or nonstandard equipment likely to affect the noise characteristics of the airplane.

(3) Maximum certificated takeoff weights.

(4) Airspeed in knots for each overflight of the measuring point.

(5) Engine performance in terms of revolutions per minute and other relevant parameters for each overflight.

(6) Aircraft height in feet determined by a calibrated altimeter in the aircraft, approved photographic techniques, or approved tracking facilities.

(g) Aircraft speed and position and engine performance parameters must be recorded at an approved sampling rate sufficient to ensure compliance with the test procedures and conditions of this appendix.

Sec. F36.111 Flight procedures.

(a) Tests to demonstrate compliance with the noise level requirements of this appendix must include at least six level flights over the measuring station at a height of 1,000' ±30' and ±10 degrees from the zenith when passing overhead.

(b) Each test over flight must be conducted:

(1) At not less than the highest power in the normal operating range provided in an Airplane Flight Manual, or in any combination of approved manual material, approved placard, or approved instrument markings; and

(2) At stabilized speed with propellers synchronized and with the airplane in cruise configuration, except that if the speed at the power setting prescribed in this paragraph would exceed the maximum speed authorized in level flight, accelerated flight is acceptable.

PART C—DATA CORRECTION

Sec. F36.201 Correction of data.

(a) Noise data obtained when the temperature is outside the range of 68 degrees F. ±9 degrees F., or the relative humidity is below 40 percent, must be corrected to 77 degrees F. and 70 percent relative humidity by a method approved by the FAA.

(b) The performance correction prescribed in paragraph (c) of this section must be used. It must be determined by the method described in this appendix, and must be added algebraically to the measured value. It is limited to 5dB(A).

(c) The performance correction must be computed by using the following formula:

$$\Delta\text{dB} = 60 - 20 \log_{10} \left\{ (11,430 - D_{50}) \frac{R/C}{V_y} + 50 \right\}$$

Where:

D_{50} =Takeoff distance to 50 feet at maximum certificated takeoff weight.

R/C=Certificated best rate of climb (fpm).

V_y =Speed for best rate of climb in the same units as rate of climb.

(d) When takeoff distance to 50' is not listed as approved performance information, the figures of 2000 for single-engine airplanes and 1600' for multi-engine airplanes must be used.

Sec. F36.203 Validity of results.

(a) The test results must produce an average dB(A) and its 90 percent confidence limits, the noise level being the arithmetic average of the corrected acoustical measurements for all valid test runs over the measuring point.

(b) The samples must be large enough to establish statistically a 90 percent confidence limit not to exceed ±1.5 dB(A). No test result may be omitted from the averaging process, unless omission is approved by the FAA.

PART D—NOISE LIMITS

Sec. F36.301 Aircraft noise limits.

(a) Compliance with this section must be shown with noise data measured and corrected as prescribed in Parts B and C of this appendix.

(b) For airplanes for which application for a type certificate is made on or after October 10, 1973, the noise level must not exceed 68 dB(A) up to and including aircraft weights of 1,320 pounds (600 kg.). For weights greater than 1,320 pounds up to and including 3,630 pounds (1,650 kg.) the limit increases at the rate of 1 dB/165 pounds (1 dB/75 kg.) to 82 dB(A) at 3,630 pounds, after which it is constant at 82 dB(A). However, airplanes produced under type certificates covered by this paragraph must also meet paragraph (d) of this section for the original issuance of standard airworthiness certificates or restricted category airworthiness certificates if those airplanes have not had flight time before the date specified in that paragraph.

(c) For airplanes for which application for a type certificate is made on or after January 1, 1975, the noise levels may not exceed the noise limit curve prescribed in paragraph (b) of this section, except that 80 dB(A) may not be exceeded.

(d) For airplanes for which application is made for a standard airworthiness certificate or for a restricted category airworthiness certificate, and that have not had any flight time before January 1, 1980, the requirements of paragraph (c) of this section apply, regardless of date of application, to the original issuance of the certificate for that airplane.

[Doc. No. 13243, 40 FR 1035, Jan. 6, 1975; 40 FR 6347, Feb. 11, 1975, as amended by Amdt. 36-6, 41 FR 56064, Dec. 23, 1976; Amdt. 36-6, 42 FR 4113, Jan. 24, 1977; Amdt. 36-9, 43 FR 8754, Mar. 2, 1978; Amdt. 36-13, 52 FR 1836, Jan. 15, 1987; Amdt. 36-16, 53 FR 47400, Nov. 22, 1988]

APPENDIX G TO PART 36—TAKEOFF NOISE REQUIREMENTS FOR PROPELLER-DRIVEN SMALL AIRPLANE AND PROPELLER-DRIVEN, COMMUTER CATEGORY AIRPLANE CERTIFICATION TESTS ON OR AFTER DECEMBER 22, 1988

PART A—GENERAL

Sec.

G36.1 *Scope.*

PART B—NOISE MEASUREMENT

G36.101 *General Test Conditions.*

G36.103 *Acoustical measurement system.*

G36.105 *Sensing, recording, and reproducing equipment.*

G36.107 *Noise measurement procedures.*

G36.109 *Data recording, reporting, and approval.*

G36.111 *Flight procedures.*

PART C—DATA CORRECTIONS

G36.201 *Corrections to Test Results.*

G36.203 *Validity of results.*

PART D—NOISE LIMITS

G36.301 *Aircraft Noise Limits.*

PART A—GENERAL

Section G36.1 Scope. This appendix prescribes limiting noise levels and procedures for measuring noise and adjusting these data to standard conditions, for propeller driven small airplanes and propeller-driven, commuter category airplanes specified in §§36.1 and 36.501(c).

PART B—NOISE MEASUREMENT

Sec. G36.101 General Test Conditions.

(a) The test area must be relatively flat terrain having no excessive sound absorption characteristics such as those caused by thick, matted, or tall grass, by shrubs, or by wooded areas. No obstructions which significantly influence the sound field from the airplane may exist within a conical space above the measurement position, the cone being defined by an axis normal to the ground and by a half-angle 75 degrees from the normal ground axis.

(b) The tests must be carried out under the following conditions:

(1) No precipitation;

(2) Ambient air temperature between 36 and 95 degrees F (2.2 and 35 degrees C);

(3) Relative humidity between 20 percent and 95 percent, inclusively;

(4) Wind speed may not exceed 10 knots (19 km/h) and cross wind may not exceed 5 knots (9 km/h), using a 30-second average;

(5) No temperature inversion or anomalous wind condition that would significantly alter the noise level of the airplane when the noise is recorded at the required measuring point, and

(6) The meteorological measurements must be made between 4 ft. (1.2 m) and 33 ft. (10 m) above ground level. If the measurement site is within 1 n.m. of an airport meteorological station, measurements from that station may be used.

(c) The flight test procedures, measuring equipment, and noise measurement procedures must be approved by the FAA.

(d) Sound pressure level data for noise evaluation purposes must be obtained with acoustical equipment that complies with section G36.103 of this appendix.

Sec. G36.103 Acoustical Measurement System.

The acoustical measurement system must consist of approved equipment with the following characteristics: (a) A microphone system with frequency response compatible with measurement and analysis system accuracy as prescribed in section G36.105 of this appendix.

(b) Tripods or similar microphone mountings that minimize interference with the sound being measured.

(c) Recording and reproducing equipment characteristics, frequency response, and dynamic range compatible with the response and accuracy requirements of section G36.105 of this appendix.

(d) Acoustic calibrators using sine wave or broadband noise of known sound pressure level. If broadband noise is used, the signal must be described in terms of its average and maximum root-mean-square (rms) value for non-overload signal level.